23 00 00 • HEATING, VENTILATING & AIR CONDITIONING

SECTION INCLUDES

Heating System
Air Supply System
Fuel Tanks
Ventilation

RELATED SECTIONS

02 04 50	Underground Tank Removal
06 10 00	Rough Carpentry
07 50 00	Membrane Roofing
22 00 00	Plumbing
26 00 00	Electrical

Filed Sub Bid

M.G.L. c.149 §44F

Heating, Ventilating, and Air Conditioning is a stipulated filed sub-bid category under M.G.L. Chapter 149, §44F. If the estimated cost of the work in this section exceeds $20,000 it should be included as a filed sub-trade.

In addition, if any subcategories of this trade, such as pipe Insulation, sheet metal, duct insulation, temperature controls, etc. are estimated to cost over $10,000 the filed sub-bidders for this trade shall be explicitly instructed to list sub-subs on their Form for Sub-bid.

RESEARCH AND INVESTIGATION

FUEL CHOICE

The first choice of fuel is natural gas with No. 2 fuel oil as second choice if gas is not available. Although the fuel costs associated with natural gas are generally higher than oil, it is a cleaner burning fuel and thus will theoretically be less maintenance intensive. Additionally, by using natural gas, fuel storage and it's associated regulatory and environmental problems do not become issues.

EQUIPMENT

Atmospheric heating equipment is preferred over higher efficiency equipment (e.g. condensing boilers) because it provides lower life cycle cost. Space constraints may dictate that smaller footprint, high efficiency equipment be used. Choose a manufacturer with at least 10 years of experience in the United States.

Make sure the existing electrical power supply is adequate for the equipment you are considering.

AIR VS. HYDRONIC

Air and hydronic systems each have their advantages and disadvantages. Except in replacement situations, the type of system should be determined primarily by project design considerations such as expected tenancy and the ability of the LHA to maintain the system.

In replacement situations the type of system should be determined by the existing distribution system. The exception is steam systems, which should be reconfigured to hydronic or air.

Provide combustion air/ventilation to the mechanical room as required by the manufacturer's installation requirements and the applicable codes.

In New Construction the type of Development will dictate the distribution system:

- Family — Air or Hydronic
- Elderly — Air or Hydronic
- Special Needs — Air with cooling

LHA CAPACITY

Routine LHA maintenance and service requirements of the installed equipment need to be reviewed. Equipment that requires extraordinary maintenance procedures or require the services of specially trained service technicians (technicians that require significant additional training for a specific piece of equipment) should be avoided.

The LHA should be consulted regarding the capabilities of their maintenance staff as well as the availability and capability of local service companies. The specified equipment should be able to be serviced by at least 3 vendors located within 30 miles of the installation.

HYDRONIC SYSTEMS

DESIGN

Size, location and construction of mechanical rooms is critical. Where central boilers are utilized, mechanical rooms located directly adjacent to tenant spaces should be avoided unless given significant consideration to noise and vibration control. Mechanical rooms must be isolated from living spaces to minimize noise and vibration.

Ensure adequate service space is provided around equipment (not necessarily limited to the minimum manufacturer's requirements).

All boiler room components and zone valves are to be installed with isolation valves to facilitate replacement.

Boilers and equipment should be located off the floor on concrete blocks rather than poured in place concrete pads.

Through the roof flues are preferred.

Air separation devices are mandatory.

Membrane expansion tanks are mandatory.

Calculate heating loads using the most current standards for residential construction e.g. ASHREA manual J etc., using the following assumptions:

- Replacement boilers should be sized to the larger of the current design load or the connected load. Do not assume the existing boiler is sized correctly.
- Heating plants should be sized at no more than 125% of the design load (as required by code).
- Combustion efficiency should not be less than that required by the current energy code.
- Design transmission for the overall U-factor of the building should be calculated for normal operating conditions, that is, with building components installed as specified and windows and doors closed.
- Multiple boiler systems should be sized to provide maximum reliability. i.e. one boiler should still provide heat for most operating conditions.
- For improved reliability in multi-dwelling buildings, consider smaller boilers in multiple installations that fire sequentially as needed.
- Where two **or more** atmospheric boilers are installed, with one as primary and one as backup, each boiler shall be sized for 2/3 capacity of the design or connected load, whichever is larger.

Where piping passes through walls or floors, holes should be large enough such that the piping does not touch the structure directly. If necessary, provide appropriate sleeves at penetrations to prevent pipe from rubbing against the structure.

Fire stop and water seal these penetrations as applicable.

Locate zone valves in accessible locations, e.g. within the unit under the baseboard radiator cover, not in crawl spaces if piping is located within a crawl space.

Heating zones should be piped in series loops for ease of balancing. Branch loops should be piped in a reverse return configuration. Monoflow fittings should be used if no other alternative exists.

Two story apartments should be separated into two heating zones where practical. Self-contained control valves should be avoided.

Evaluate the reuse of existing steam radiators or convectors in steam-to-hydronic conversions.

Lay out residential baseboard radiators for economy, ease of construction, and efficiency of operation.

- Baseboard radiation should be located under windows or at exterior walls.

- Do Not locate baseboard heaters near toilets especially in family units. They tend to rust. Use durable products that minimize this tendency
- Piping should not be installed in unheated spaces that are subject to freezing temperatures. If unavoidable provide insulation above that required by code and provide heat to keep above freezing.
- Piping should always be enclosed. This may be accomplished by concealing the piping in walls or floors, or by providing baseboard enclosures. If piping is run in walls or floors, it should be located such that accidental puncturing by nails, screws, etc. can be avoided.
- Runs should be as short as possible.

Materials

Equipment manufacturers should be able to provide documentation demonstrating that their products have proven reliable for a significant period of time in similar installations.

Equipment manufacturers must also be willing to inspect the finished installation and certify in writing that the installation is in accordance with their requirements.

Solder containing lead is not allowed.

PEX piping is suitable for underground piping applications and should be considered to facilitate retrofitting existing systems it if piping needs to be replaced.

PEX tubing is permissible for distribution piping in concealed areas. For exposed basement ceiling distribution piping, copper tubing is preferred.

For ease of maintenance and repair, there should be no PEX tubing connections that are inaccessible or concealed.

If using copper piping for interior distribution use Type L.

Ball valves should be used for shut-offs wherever possible.

Outdoor reset and hot water priority are two control options for equipment serving 2 or more dwelling units.

Thermostats for elderly units should be mercury free, non-programmable, with ½" numbers and have operating limit features.

Baseboard radiation for family developments should be heavy gauge materials with a top that is narrow, be sloped and have no damper.

AIR SUPPLY SYSTEMS

Design

Place the mechanical equipment in a central location to simplify the duct layout and reduce duct size. The equipment should be easily accessible for service.

Provide slightly more fresh air than what is being mechanically exhausted.

Reference SMACNA standards for duct construction.

http://www.smacna.org

Thermally insulate ducts and locate them below the attic in order to maximize energy conservation and eliminate ceiling penetrations.

Duct joints should be sealed mastic or mastic with tape, not tape alone.

For non-sleeping spaces, provide a common return in the hall or ideally in the entry.

Provide bedrooms with their own return and supply; venting through a closet door helps to ventilate that space.

Undercutting or louvering of bedroom doors compromises acoustic privacy.

Avoid floor registers.

For DMH units which will be occupied by cigarette smokers, consider providing at the return air handler a rack of filters including an electrostatic air cleaner.

If you are scoping a forced hot air replacement project, make sure the existing ductwork is properly sized and is of sound construction and repair. Also investigate how long it has been since the ducts have been cleaned. If more than five years will have elapsed between the when the ducts were cleaned and when the project is underway, please include duct cleaning as part of your project.

COOLING

Cooling load calculations (applicable to special needs housing only) should reflect residential occupancy, not commercial standards, and account for shading of windows.

Locate air conditioning condensers in shade to maximize operating efficiency. Minimize pipe runs. Ensure that the equipment is accessible for maintenance and repair by providing service access on at least three sides. The condenser should be located away from bedroom windows so that residents are not disturbed by the noise.

Whenever feasible use ductless air conditioners to cool for Community Buildings, office space and public areas.

EQUIPMENT VENTING

DESIGN

Equipment Venting should preferably terminate through the roof were practical. Sidewall venting should be avoided if venting through the roof is a reasonable option. Each piece of equipment should be vented separately to the outdoors where practical. The lengths of vents on high efficiency equipment must be carefully examined to prevent condensation of the flue gasses. Condensation could also be a problem where high efficiency equipment vents are connected to existing masonry chimneys. In all cases the equipment manufacturer must be consulted.

Where equipment is sidewall horizontally vented, attempt to locate the vent termination not less than seven (7) feet above finished grade. Where this cannot be accomplished comply with NFPA-54 Chapter 10 requirements.

The reuse of chimneys, particularly exterior masonry chimneys, must be in accordance with code. If you are planning on using an existing chimney, make sure the chimney is the proper size for the considered equipment and that the chimney is of sound construction and repair. When converting from oil to gas check to see if the chimney needs to be cleaned.

All ductwork for heating and cooling must be thermally insulated and sealed with mastic or mastic and tape, not tape alone.

Do Not use any material containing Asbestos.

Combustion air requirements must be provided in accordance with code.

BUILDING VENTILATION

DESIGN

ANSI/ASHRAE STANDARD 62.2-2400: Is the recommended guide for residential ventilation:

http://resourcecenter.ashrae.org/store/ashrae/newstore.cgi?categoryid=156&categoryparent=2

Mechanical bathroom ventilation must be provided, particularly in new or modernized building envelope construction.

Utilize fans that will operate on some type of timing device. Systems that are controlled solely from a light switch or wall switch do not operate for sufficient lengths of time to adequately remove the moisture generated from showering (particularly in family housing). Some switches will allow the fan to operate for a fixed period of time (field adjustable) after the lights have been turned off.

In exceptionally humid situations it may be necessary to install a humidistat.

MATERIAL

Fans should be as quiet as possible (<2.0 sones) to resist attempts at tampering by the residents.

Fans should be rated for the intended uses i.e. UL rated for bath and shower area.

Bathroom wall fans ducted to the outside are not allowed.

Ductwork should be rigid and corrosion resistant. Flexible ductwork is not acceptable.

Small capacity in-line fans installed in attic spaces which are not accessible by the residents but are accessible to the LHA staff have been used effectively.

Kitchen fans **Should be** vented to the exterior, where possible.

ROOF TOP VENTILATION UNITS (REPLACEMENT AND NEW)

Electric systems should be converted to natural gas. Gas piping sizing for roof top units should consider other potential conversions i.e. if they have electric water heaters, clothes dryers, etc.

Ventilation rates should be based on current code requirements.

Exhaust fan operation for multiple unit mid and high rise buildings in conjunction with the operation of make up air ventilation should provide a positive pressure within the building.

The use of energy should be a consideration in the design of make up air and exhaust systems for mid and high rise systems.

Time clock (intermittent) operation particularly for kitchen exhaust fans on a defined limited schedule uses less energy than reduced ventilation rates operating continuously. Intermittent operation of multiple bath exhausts fans may not be practical. Continuous reduced rate ventilation should be considered.

FUEL TANKS

Wherever possible, fuel oil tanks should be located within the buildings.

When the work requires the removal of existing tanks this work is best done by separate contract.

When converting to gas, remove all fill piping and wall penetrations and patch exterior walls.